Why do some people look older than they should?

C J Bulpitt, H L J Markowe, M J Shipley

Abstract

***Background*—As a component of studies on biological age, the age of subjects from their appearance (perceived age) was estimated.**

***Objective*—To determine the factors associated with looking older.**

***Methods*—Cross sectional study of London civil servants (318 men, 129 women) in the Department of the Environment study. Perceived age was recorded by an observer and the difference between this age and chronological age was analysed according to 20 different variables.**

***Results*—Men had an average perceived age of 0.37 years older than their actual age and women a perceived age of 0.54 years younger. In men, looking older was related to greying of the hair, grade of arcus senilis, and grade of baldness. Less expected, looking older was positively related to total serum cholesterol (p=0.03) and blood haemoglobin (p<0.01). In women, looking older was related to greying of the hair, positively to blood erythrocyte sedimentation rate (ESR), and negatively to serum bilirubin (p=0.01). Looking older was not related to alcohol consumption, employment grade, serum high density lipoprotein cholesterol, glucose, albumin, and calcium in either sex.**

***Conclusion*—The relationships between looking older and total cholesterol and haemoglobin in men and ESR and bilirubin in women, require further investigation.**

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Section of Care of the Elderly, Imperial College School of Medicine, Hammersmith Hospital, Du Cane Road, London W12 0NN, UK
C J Bulpitt

Central Health Monitoring Unit, Department of Health, London, UK
H L J Markowe

Department of Epidemiology and Public Health, University College London Medical School, London, UK
M J Shipley

Correspondence to:
Professor Bulpitt
c.bulpitt@ic.ac.uk

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It is well recognised that people look older in the face when they have more than the expected number and extent of wrinkles and a corresponding lack of skin elasticity.[1] Elastic fibres in the skin degenerate and thicken when the skin is exposed to sunlight.[2 3] Warren *et al* reported that estimated age was increased by solar exposure in middle aged but not young women. The increase in an age group 45–51 years was four years.[1]

In addition it has long been recognised that smokers look older,[4–9] although the relative contribution of say, wrinkles and less subcutaneous fat has to be determined.

Intuitively looking older should also be associated with markers of ageing such as having more grey hair or becoming bald. Moreover other variables should be associated with higher estimated ages when they are either causally related to loss of skin elasticity or simply associated with greying of hair, baldness, exposure to sun, etc. This article reports the association of many of these variables and biochemical measures to looking older in subjects in the Department of Environment study.[10] This study of London civil servants was directed at determining differences in social class (employment grade) and included measures of ageing.

Methods

The selection of subjects has been described. The subjects were a sample, stratified by age, gender, and employment grade and randomly selected using different sampling fractions to provide equal numbers in each age and grade group.[11] Of the 397 men in the study 318 had an estimated (perceived) age recorded when first seen by the research staff and of the 130 women, 129 had this investigation. Chronological age ranged from 37 to 58 years.

ASSESSMENT OF AGEING

The following measures were made specifically for this purpose:

Estimated or perceived age

One observer "guessed" the age of the subject when first seen, fully dressed, without reference to the records. First impression had to be recorded before interview or examination and the observers were two female research nurses and one male doctor between the ages of 25 and 35 years.

Baldness

This was assessed on a four point scale between 1 = no hair loss, and 4 = only sparse hair over the ears and a fringe round the back.

Greyness of hair

A sample of hair was taken from the back of the head, and the percentage of hairs that were grey was calculated in 50 hairs. The results were excluded in 45 women, who were thought to have dyed their hair. The percentage of subjects having any grey hair and among those with grey hair, the percentage of hairs that were grey were used as separate and independent measures of the effect of grey hair.

Skin inelasticity

The skin over the "snuff box", the area between the right first and second proximal metacarpals, was pinched for 50 seconds, using an ordinary spring assisted wooden clothes peg. On release of the peg, the number of seconds the pinched skin took to return to normal was measured.

Arcus senilis

The presence of arcus senilis was graded as 1 = absent, 2 = extending for less than a semicircle, 3 = extending more than a semicircle but not a full circle, and 4 = present as a full circle.

OTHER

Blood pressure

A standard mercury sphygmomanometer and cuff (inflatable section 11 × 2.5 cm) was employed on the right arm after the subject had been lying down for five minutes.

Blood tests

These consisted of measurements of serum albumin, calcium, bilirubin, cholesterol, high density lipoprotein (HDL) cholesterol, creatinine, urate, glucose; erythrocyte sedimentation rate (ESR), and haemoglobin. These biochemical and haematological methods and results have been reported previously.[12]

STATISTICAL METHODS

There was a strong correlation between estimated age and actual age. Because of measurement error related to regression to the mean, one would expect differences between the estimated minus actual age to be negatively associated with actual age. To overcome this dependency, estimated age was regressed on actual age using linear regression. The residuals from this regression give the difference between each subject's estimated age and that predicted from their actual age. A high residual indicates that an individual looks older than their actual age. The study population was partitioned into four equal groups using the residual quartiles, separately for men and women. Subjects who looked youngest were in quarter 1 and those looking oldest were in quarter 4. The means of the ageing variables for each of these four groups were adjusted for actual age to remove the slight effect of any remaining confounding of actual age. Regressions of the ageing variables on the estimated age residuals with adjustment for actual age (individual data) were used to test for linear trend in preference to testing for linear trend in the means or proportions in the four groups. For ease in reading the text the "estimated age residuals" will be termed "excess perceived age".

As previously described the percentage of hairs that were grey, skin inelasticity, blood ESR, and serum bilirubin were all better represented by a logarithmic transformation. These measurements were transformed to a log scale (after adding one for skin elasticity) and these values were used in all analyses. All other factors could be described using a normal distribution.

Tests for heterogeneity in guessing age between the three observers were statistically significant for the female subjects (p=0.02) but not for the men (p= 0.30). Adjusting for differences between the observers did not importantly alter the results and the slight differences are discussed.

Results

The 318 men had an estimated age that averaged 48.19 years with a range of 28–65 years. This was 0.37 years higher than the average chronological age of 47.82 years (range 37–58 years). In contrast the 129 women had a lower average estimated age of 46.93 years (range 30–62 years) compared with an average chronological age of 47.47 years and range of 38–57 years. In women, therefore, the mean estimated age was 0.54 years lower than their actual age.

The estimated age minus actual age difference decreased with age from 0.8 years in men aged 37–44 to −0.9 years in men aged 55–58. In women this expected effect was not observed and women aged 38–44 had an average estimated actual age of −1.1 years whereas women of 55–57 years had an estimated actual age difference of 0.1 years. Estimated age naturally increased with the age residuals. Nevertheless the mean estimated age in men and women was similar for each quarter of "excess perceived age" (table 1). Table 1 also demonstrates that the four strata of excess perceived age were independent of actual chronological age.

Tables 2 and 3 gives means and percentages for the four excess perceived age groups, for 20 variables that were of interest in connection with estimated age. In men, the proportion of hairs that were grey, and in women, the proportion having any grey hair were both higher in the higher estimated age groups. Men looked older than their chronological age when blood haemoglobin was higher, serum cholesterol higher, arcus senilis and baldness greater. These associations could not be confirmed in the smaller number of women. In men associations of skin inelasticity and lying systolic blood pressure with higher age could not be excluded with any confidence (p=0.09) and in both sexes an association with serum creatinine (negative) could not be excluded with any certainty. In women, there was evidence that a higher ESR and a lower serum bilirubin was associated with looking older. The "oldest looking" groups of both men and women had the highest percentages of current smokers, although the linear trends were not statistically significant.

Table 1 Estimated age residuals (excess perceived age), chronological age, and estimated age in four quarters of "estimated age residuals" in men and women separately. The results show that the four strata of excess perceived age were independent of chronological age. Estimated ages were similar in both men and women in the four quarters

	Men: quarter of estimated age residuals				*Women: quarter of estimated age residuals*			
	1 (low)	*2*	*3*	*4 (high)*	*1 (low)*	*2*	*3*	*4 (high)*
No	79	77	81	81	33	31	33	32
Estimated age residuals (years)								
Minimum	−15.6	−3.3	0.2	3.2	−11.7	−4.2	−0.2	3.6
Mean	−6.4	−1.7	1.5	6.3	−6.8	−2.2	1.7	7.3
Maximum	−3.3	0.2	3.2	16.3	−4.2	−0.2	3.6	18.9
Mean								
Chronological age (years)	47.3	48.1	48.7	47.2	45.5	48.5	49.3	46.6
Estimated age (years)	41.3	46.8	50.5	54.0	38.1	45.8	50.5	53.4

Table 2 Means and percentages (adjusted for chronological age) according to quarter of estimated age residuals (excess perceived age) in both men and women. Men and women who looked the oldest (quarter 3–4) tended to have more grey hair and the men were more bald and had more developed arcus senilis

	Men: quarter of estimated age residuals					*Women: quarter of estimated age residuals*				
	1 (low)	*2*	*3*	*4 (high)*	*p Value (for linear trend)*	*1 (low)*	*2*	*3*	*4 (high)*	*p Value (for linear trend)*
Any grey hair (%)	56.4	64.9	67.9	66.3	0.22	14.3	52.9	42.3	60.0	0.02
% Hairs that are grey*	6.5	10.7	12.7	11.9	0.003	14.7	10.2	11.2	10.9	>0.5
Arcus senilis (grade)	1.51	1.65	1.71	1.83	0.02	1.53	1.38	1.50	1.44	>0.5
Baldness (grade)	2.17	2.33	2.30	2.45	0.02	1.28	1.25	1.25	1.33	>0.5
Skin inelasticity (secs)	2.90	2.77	3.09	3.50	0.09	4.63	4.71	4.15	4.79	0.44
Lying SBP (mm Hg)	126.7	126.4	129.1	129.0	0.09	124.5	119.8	122.6	125.2	0.49
Alcohol (units/week)	9.8	6.8	9.5	8.9	>0.5	4.6	3.6	4.7	5.3	0.46
Current smokers (%)	30.4	29.9	24.7	33.3	0.34	30.3	41.9	18.2	48.4	>0.5
Low employment grade (%)	26.6	19.5	17.3	29.6	>0.5	48.5	58.1	45.5	46.9	>0.5
BMI (kg/m^2)	24.3	24.6	24.6	25.0	0.14	23.1	25.1	24.3	24.3	0.30

*Only among those subjects having some grey hair.
SBP = systolic blood pressure; BMI = body mass index.

Table 3 Mean biochemical and haematological factors (adjusted for chronological age) according to quarters of estimated age residuals in both men and women. Men who looked oldest (quarter 3–4) had a higher average haemoglobin and cholesterol, and women had a higher average ESR

	Men: quarter of estimated age residuals					*Women: quarter of estimated age residuals*				
	1 (low)	*2*	*3*	*4 (high)*	*p Value (for linear trend)*	*1 (low)*	*2*	*3*	*4 (high)*	*p Value (for linear trend)*
Blood haemoglobin (g/l)	147	148	150	151	0.005	135	133	135	135	>0.5
Serum cholesterol (mmol/l)	5.90	5.89	6.08	6.10	0.03	5.91	6.07	5.92	6.12	0.21
Blood ESR (mm/hour)	3.20	2.75	2.98	3.26	0.31	4.42	4.10	6.22	6.72	0.007
Serum										
Creatinine (μmol/l)	97.3	96.5	96.5	94.3	0.16	78.7	80.6	76.9	76.8	0.15
Urate (μmol/l)	358	353	361	360	>0.5	249	271	261	273	0.10
HDL cholesterol (mmol/l)	1.13	1.12	1.17	1.10	0.38	1.44	1.48	1.41	1.41	>0.5
Bilirubin (μmol/l)	10.1	10.3	9.6	10.2	0.48	9.4	8.6	9.4	7.1	0.012
Glucose (mmol/l)	5.38	5.38	5.52	5.34	>0.5	5.52	4.97	5.25	4.95	>0.5
Albumin (g/l)	44.8	44.5	45.0	44.4	>0.5	44.0	43.7	43.4	43.4	0.39
Calcium (mmol/l)	2.41	2.41	2.41	2.42	0.49	2.39	2.38	2.37	2.38	>0.5

ESR = erythrocyte sedimentation rate; HDL = high density lipoprotein.

Alcohol intake, employment grade, serum calcium, albumin, HDL cholesterol, and glucose concentrations are included in the tables as examples of variables that were not associated with looking older in either men or women.

Discussion

The results confirm the expected associations between looking older and having more grey hairs and, in men, having a more extensive arcus senilis and more extensive baldness. The relationship between skin inelasticity (measured in the "snuff box") and looking older did not achieve statistical significance on our individual patient data analysis, but an assessment of a linear trend in the means for the four groups in men was statistically significant ($p<0.03$). Moreover, our measure of elasticity was an inexpensive, crude assessment and the result may have been different if we had employed more modern technology and made measurements over the face.[1]

There was no association between either alcohol consumption or employment grade and looking older in our study. We expected that those with a low body mass index would look older, as weight loss is thought to make a subject look older, but there was no evidence for this association. However we did not have information on previous weight and could not estimate weight loss. The percentage of current smokers was not linearly associated with looking older. However there was a trend for the oldest group to have the highest percentage of smokers. The fact that office workers have little "at work" solar exposure may explain these negative findings.

In men, serum cholesterol was increased in those looking older. However, HDL cholesterol was not importantly related to looking older. Two possibilities can be suggested: first that a high serum cholesterol leads to a loss of skin elasticity, but there is no evidence to support this; second that cholesterol is positively related to one of the variables that do make people look older. Cholesterol, arcus senilis, baldness,[13] and smoking are all related to coronary artery disease, and possibly to each other. Similar arguments may be employed for haemoglobin and, for women, ESR. In fact, in the present database, cholesterol was strongly related to arcus senilis but was not related to grey hair, baldness, or smoking.

Women had a lower serum bilirubin ($p=0.012$) if they looked older. Chan-Yeung *et al* reported a decrease in serum bilirubin in smokers.[14] Adjusting for observer differences did not render any of the statistically significant results "non-significant" but did alter the linear relationship between urate and perceived age from $p=0.10$ to $p=0.03$, supporting the concept that a higher serum urate is related to looking older in women.

The present study is probably the first to relate systematically the difference between perceived age and chronological age to several variables related to ageing. We took great care to ensure that our measures of "looking older" were independent of chronological age and recommend our statistical methods to other authors. Nevertheless a larger study, especially

Key points

- In men looking older than you should is related to a high serum cholesterol and haemoglobin.
- In women looking older may be related to a high ESR and a low serum bilirubin.
- Predictably looking older was related to baldness, greying of the hair, arcus senilis, and skin inelasticity.

in women, is desirable and such a study should employ more sophisticated measures of skin inelasticity. For women the study lacked the power to detect an increase in cholesterol in those who looked older. The difference between the lowest and highest quarters was 0.21 mmol/l and 95% confidence intervals (−0.27 to +0.67 mmol/l).

The present methods should be expanded and several different observers asked to assess the age of the subjects. This could be easily achieved by good photographic or videographic records, although these would have to be shown to produce an estimate close to that made on a "real" subject. Whatever method is employed interobserver and intraobserver variability will have to be determined and this was determined for most measurements in the Department of the Environment study but not for perceived age. Interestingly the three observers' estimated age assessments were in fair agreement with actual age in men but not women. In men one observer estimated age as 0.7 years older on average, one very close to actual age on average, and one 0.5 years younger (p=0.30 for heterogeneity). In women however, one observer estimated age 1.9 years older, a second observer 0.6 years older, and the third an average of 1.7 years younger (p=0.02 for heterogeneity). Olde Rikkert made a visual estimation of age using a simple checklist and found good inter-rater agreement.[15]

The effects of solar damage were probably only partly negated by being office workers in London and more information needs to be collected about this aspect. The subjects also had a rather narrow age range of 37 to 58 years. This may be an advantage in excluding younger subjects who are less likely to show ageing changes in the face[1] and older subjects who may have coexistent morbidity.

In conclusion, a high serum cholesterol and haemoglobin is related to looking older in men and this requires further investigation and confirmation. Similarly, in women, looking older was associated with a high ESR and low bilirubin. The associations between looking older and baldness, greying of the hair, arcus senilis, and skin inelasticity were predictable.

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